WHAT IS CLAIMED IS:

1. A hearing aid, comprising:

an input signal channel providing digital input signals;

a signal path adapted to process said digital input signals in accordance with a predetermined signal processing algorithm to produce a digital output signal, wherein said signal path further comprises at least one signal processing function operating on a warped frequency scale, and wherein said at least one signal processing function includes at least one spectral enhancement algorithm; and

an output conversion means adapted to convert said output signals to an audio output.

2. The hearing aid of claim 1, wherein said at least one signal processing function further comprises a plurality of cascaded all-pass filters.

3. The hearing aid of claim 1, wherein said warped frequency scale approximates a Bark scale.

4. A frequency-warped processing system, comprising:

an input signal channel providing digital input signals;

a plurality of cascaded all-pass filters, wherein said digital input signals pass through said plurality of cascaded all-pass filters, and wherein said plurality of cascaded all-pass filters output a sequence of delayed samples;

means for applying a frequency domain transform on said sequence of delayed samples, wherein a warped sequence results from said frequency domain transform applying means;

means for calculating a plurality of frequency domain level estimates from said warped sequence;

means for calculating a plurality of frequency domain gain coefficients from said plurality of frequency domain level estimates;

means for calculating a plurality of spectral enhancement gain coefficients from said warped sequence;

means for calculating a plurality of compression-spectral enhancement gain coefficients from said plurality of frequency domain gain coefficients and said plurality of spectral enhancement gain coefficients;

means for applying an inverse frequency domain transform on said plurality of compression-spectral enhancement gain coefficients, wherein a set of time-domain filter coefficients of a compression gain filter result from said inverse frequency domain transform applying means; and

means for convolving said sequence of delayed samples with said set of time-domain filter coefficients to produce a digital output signal.

5. The frequency-warped processing system of claim 4, said means for calculating said plurality of spectral enhancement gain coefficients further comprising a spectral enhancement algorithm, wherein said spectral enhancement algorithm raises a power spectrum comprised of said plurality of frequency domain level estimates to a power greater than 1.

6. The frequency-warped processing system of claim 4, said means for calculating said plurality of spectral enhancement gain coefficients further comprising a spectral enhancement algorithm, wherein said spectral enhancement algorithm amplifies a plurality of peaks of said warped sequence.

7. The frequency-warped processing system of claim 6, wherein said spectral enhancement algorithm further comprises means for identifying said plurality of peaks, said identifying means including means for applying a second-difference operator to said warped sequence.

8. The frequency-warped processing system of claim 4, said means for calculating said plurality of spectral enhancement gain coefficients further comprising a spectral enhancement algorithm, wherein said spectral enhancement algorithm includes means for forming an unsmeared warped sequence, and means for calculating the difference between said warped sequence and said unsmeared warped sequence.

9. The frequency-warped processing system of claim 4, further comprising a hearing aid, wherein the frequency-warped processing system is incorporated within said hearing aid.

10. The frequency-warped processing system of claim 4, wherein said plurality of frequency domain gain coefficients comprise a warped time-domain filter.

11. The frequency-warped processing system of claim 4, further comprising means for windowing said sequence of delayed samples, wherein a windowed sequence of delayed samples results from said windowing means, and wherein said warped sequence results from applying said frequency domain transform to said windowed sequence of delayed samples.

12. The frequency-warped processing system of claim 4, further comprising a digital-to-analog converter, said digital-to-analog converter converting said digital output signals to analog output signals.

13. The frequency-warped processing system of claim 12, further comprising an output transducer, said output transducer converting said analog output signals to an audio output.

14. The frequency-warped processing system of claim 4, said plurality of cascaded all-pass filters comprising a plurality of first order all-pass filters.

15. The frequency-warped processing system of claim 4, said sequence of delayed samples comprising 16 samples.

16. The frequency-warped processing system of claim 4, further comprising a digital processor, wherein said digital processor is adapted to provide said frequency domain transform applying means, said frequency domain level estimates calculating means, said frequency domain gain coefficients calculating means, said spectral enhancement gain coefficients calculating means, said inverse frequency domain transform applying means, and said means for convolving said sequence of delayed samples.

17. The frequency-warped processing system of claim 16, wherein said digital processor comprises a software programmable digital signal processor.

18. The frequency-warped processing system of claim 4, wherein said frequency domain transform applying means uses a transform selected from the group

consisting of discrete Fourier transforms, fast Fourier transforms, Goertzel transforms, and discrete cosine transforms.

19. The frequency-warped processing system of claim 4, further comprising:

an input transducer, said input transducer converting audio input signals to analog input signals; and

an analog-to-digital converter, said analog-to-digital converter converting said analog input signals to said digital input signals.

20. The frequency-warped processing system of claim 4, further comprising:

a digital-to-analog converter, said digital-to-analog converter converting said digital output signals to analog output signals; and

an output transducer, said output transducer converting said analog output signals to an audio output.

21. A frequency-warped processing system, comprising:

an input signal channel providing digital input signals;

an input data buffer, said input data buffer holding at least one block of data comprised of a portion of said digital input signals;

a plurality of cascaded all-pass filters, wherein a first block of said digital input signals pass from said input data buffer through said plurality of cascaded all-pass filters, and wherein said plurality of cascaded all-pass filters output a first sequence of delayed samples;

means for windowing a first portion of said first sequence of delayed samples, wherein a first windowed sequence of delayed samples results from said windowing means;

means for applying a first frequency domain transform on said first windowed sequence of delayed samples, wherein a first warped sequence results from said first frequency domain transform applying means;

means for calculating a first plurality of frequency domain level estimates of said first warped sequence;

means for calculating a first plurality of spectral enhancement gain coefficients from said first warped sequence;

means for windowing a second portion of said first sequence of delayed samples, wherein a second windowed sequence of delayed samples results from said windowing means;

means for applying a second frequency domain transform on said second windowed sequence of delayed samples, wherein a second warped sequence results from said second frequency domain transform applying means;

means for calculating a second plurality of frequency domain level estimates of said second warped sequence;

means for calculating a first plurality of spectral enhancement gain coefficients from said first warped sequence;

means for summing said first and second plurality of spectral enhancement gain coefficients, wherein a summed first and second plurality of spectral enhancement gain coefficients results from said summing means;

means for summing said first and second plurality of frequency domain level estimates, wherein a summed first and second plurality of frequency domain level estimates results from said summing means;

means for normalizing said summed first and second plurality of frequency domain level estimates, wherein a normalized first and second plurality of frequency domain level estimates results from said normalizing means;

means for calculating a plurality of frequency domain gain coefficients from said normalized first and second plurality of frequency domain level estimates;

means for calculating a plurality of compression-spectral enhancement gain coefficients from said plurality of frequency domain gain coefficients and said summed first and second plurality of spectral enhancement gain coefficients;

means for applying an inverse frequency domain transform on said plurality of compression-spectral enhancement gain coefficients, wherein a set of time-domain filter coefficients of a compression gain filter result from said inverse frequency domain transform applying means; and

means for convolving a second sequence of delayed samples with said time-domain filter coefficients, said second sequence of delayed samples produced by a second block of said digital input signals passing from said input data buffer through said plurality of cascaded all-pass filters, wherein a digital output signal results from said convolving means.

22. The frequency-warped processing system of claim 21, said means for calculating said first and second plurality of spectral enhancement gain coefficients further comprising a spectral enhancement algorithm, wherein said spectral enhancement algorithm raises a power spectrum comprised of said plurality of frequency domain level estimates to a power greater than 1.

23. The frequency-warped processing system of claim 21, said means for calculating said first and second plurality of spectral enhancement gain coefficients further comprising a spectral enhancement algorithm, wherein said spectral enhancement algorithm amplifies a plurality of peaks of said warped sequence.

24. The frequency-warped processing system of claim 23, wherein said spectral enhancement algorithm further comprises means for identifying said plurality of peaks, said identifying means including means for applying a second-difference operator to said warped sequence.

25. The frequency-warped processing system of claim 21, said means for calculating said first and second plurality of spectral enhancement gain coefficients further comprising a spectral enhancement algorithm, wherein said spectral enhancement algorithm includes means for forming an unsmeared warped sequence, and means for calculating the difference between said warped sequence and said unsmeared warped sequence.

26. The frequency-warped processing system of claim 21, further comprising a hearing aid, wherein the frequency-warped processing system is incorporated within said hearing aid.

27. The frequency-warped processing system of claim 21, wherein said plurality of frequency domain gain coefficients comprise a warped time-domain filter.

28. The frequency-warped processing system of claim 21, further comprising a digital-to-analog converter, said digital-to-analog converter converting said digital output signals to analog output signals.

29. The frequency-warped processing system of claim 28, further comprising an output transducer, said output transducer converting said analog output signals to an audio output.

30. The frequency-warped processing system of claim 21, said plurality of cascaded all-pass filters comprising a plurality of first order all-pass filters.

31. The frequency-warped processing system of claim 21, further comprising a digital processor, wherein said digital processor is adapted to provide said windowing means, said means for applying said first and second frequency domain transforms, said means for calculating said first and second plurality of frequency domain level estimates, said summing means, said normalizing means, said frequency domain gain coefficients calculating means, said inverse frequency domain transform applying means, and said convolving means.

32. The frequency-warped processing system of claim 21, wherein said means for applying said first and second frequency domain transforms use a transform selected from the group consisting of discrete Fourier transforms, fast Fourier transforms, Goertzel transforms, and discrete cosine transforms.

33. The frequency-warped processing system of claim 21, further comprising:

an input transducer, said input transducer converting audio input signals to analog input signals; and

an analog-to-digital converter, said analog-to-digital converter converting said analog input signals to said digital input signals.

34. The frequency-warped processing system of claim 21, further comprising:

a digital-to-analog converter, said digital-to-analog converter converting said digital output signals to analog output signals; and

an output transducer, said output transducer converting said analog output signals to an audio output.

35. The frequency-warped processing system of claim 21, wherein said windowing means provides a 50 percent overlap of said first and second pluralities of frequency domain level estimates.

36. The frequency-warped processing system of claim 21, wherein a quantity of samples corresponding to said first block of said digital input signals is equivalent to a quantity of first order all-pass filters corresponding to said plurality of cascaded all-pass filters.

37. The frequency-warped processing system of claim 36, wherein said first portion of said first sequence of delayed samples is comprised of a first half of said first sequence of delayed samples and said second portion of said first sequence of delayed samples is comprised of a second half of said first sequence of delayed samples.

38 A frequency-warped processing system, comprising:

an input signal channel providing digital input signals;

an input data buffer, said input data buffer holding a block of data of size M comprised of a portion of said digital input signals;

a plurality of cascaded all-pass filters comprised of 2M cascaded all-pass filters, wherein a first block of said digital input signals pass from said input data buffer through said plurality of cascaded all-pass filters to form a first sequence of delayed samples and wherein a second block of said digital input signals pass from said input data buffer through said plurality of cascaded all-pass filters to form a second sequence of delayed samples, and wherein said first sequence of delayed samples and said second sequence of delayed samples form a combined sequence of delayed samples;

means for windowing a first portion of said combined sequence of delayed samples, wherein said first portion is of size M, wherein a windowed sequence of delayed samples results from said windowing means;

means for applying a 2M-point frequency domain transform on said windowed sequence of delayed samples, wherein a warped sequence results from said frequency domain transform applying means;

means for calculating a plurality of frequency domain level estimates of said warped sequence;

means for calculating a plurality of frequency domain gain coefficients from said plurality of frequency domain level estimates;

means for calculating a plurality of spectral enhancement gain coefficients from said warped sequence;

means for calculating a plurality of compression-spectral enhancement gain coefficients from said plurality of frequency domain gain coefficients and said plurality of spectral enhancement gain coefficients;

means for applying an inverse frequency domain transform on said plurality of compression-spectral enhancement gain coefficients, wherein a set of time-domain filter coefficients of a compression gain filter result from said inverse frequency domain transform applying means; and

means for convolving a second portion of said combined sequence of delayed samples with said set of time-domain filter coefficients, wherein said second portion is of size M, wherein a digital output signal results from said convolving means.

39. The frequency-warped processing system of claim 38, said means for calculating said plurality of spectral enhancement gain coefficients further comprising a spectral enhancement algorithm, wherein said spectral enhancement algorithm raises a power spectrum comprised of said plurality of frequency domain level estimates to a power greater than 1.

40. The frequency-warped processing system of claim 38, said means for calculating said plurality of spectral enhancement gain coefficients further comprising a spectral enhancement algorithm, wherein said spectral enhancement algorithm amplifies a plurality of peaks of said warped sequence.

41. The frequency-warped processing system of claim 40, wherein said spectral enhancement algorithm further comprises means for identifying said plurality of peaks, said identifying means including means for applying a second-difference operator to said warped sequence.

42. The frequency-warped processing system of claim 38, said means for calculating said plurality of spectral enhancement gain coefficients further comprising a spectral enhancement algorithm, wherein said spectral enhancement algorithm includes

means for forming an unsmeared warped sequence, and means for calculating the difference between said warped sequence and said unsmeared warped sequence.

43. The frequency-warped processing system of claim 38, further comprising a hearing aid, wherein the frequency-warped processing system is incorporated within said hearing aid.

44. The frequency-warped processing system of claim 38, wherein said plurality of frequency domain gain coefficients comprise a warped time-domain filter.

45. The frequency-warped processing system of claim 38, further comprising a digital-to-analog converter, said digital-to-analog converter converting said digital output signals to analog output signals.

46. The frequency-warped processing system of claim 45, further comprising an output transducer, said output transducer converting said analog output signals to an audio output.

47. The frequency-warped processing system of claim 38, said plurality of cascaded all-pass filters comprising a plurality of first order all-pass filters.

48. The frequency-warped processing system of claim 38, further comprising a digital processor, wherein said digital processor is adapted to provide said windowing means, said means for applying said 2M-point frequency domain transform, said means for calculating said plurality of frequency domain level estimates, said frequency domain gain coefficients calculating means, said inverse frequency domain transform applying means, and said convolving means.

49. The frequency-warped processing system of claim 38, wherein said means for applying said frequency domain transform uses a transform selected from the group consisting of discrete Fourier transforms, fast Fourier transforms, Goertzel transforms, and discrete cosine transforms.

50. The frequency-warped processing system of claim 38, further comprising:

an input transducer, said input transducer converting audio input signals to analog input signals; and

an analog-to-digital converter, said analog-to-digital converter converting said analog input signals to said digital input signals.

51. The frequency-warped processing system of claim 38, further comprising:

a digital-to-analog converter, said digital-to-analog converter converting said digital output signals to analog output signals; and

an output transducer, said output transducer converting said analog output signals to an audio output.

52. A signal processing system, comprising:

an input signal channel providing digital input signals;

means for calculating a power spectrum for said digital input signals;

means for applying a second difference operator to said power spectrum to locate a plurality of power spectrum peaks;

means for amplifying said plurality of power spectrum peaks to achieve a modified power spectrum; and

means for producing a digital output signal from said modified power spectrum.

53. The signal processing system of claim 52, further comprising means for determining the sharpness of each of said plurality of power spectrum peaks.

54. The signal processing system of claim 53, wherein said amplifying means applies a scaling factor to the amplification applied to each of said plurality of power spectrum peaks, said scaling factor based on the determined sharpness of the peak.

55. A method of processing sound in a hearing aid, comprising the steps of:

receiving digital input signals;

passing a portion of said digital input signals through a plurality of cascaded all-pass filters to form a sequence of delayed samples;

windowing said sequence of delayed samples;

applying a frequency domain transform to said windowed sequence of delayed samples to form a warped sequence;

calculating a plurality of frequency domain level estimates from said warped sequence;

calculating a plurality of frequency domain gain coefficients from said plurality of frequency domain level estimates to form a warped time-domain filter;

calculating a plurality of spectral enhancement gain coefficients from said warped sequence;

calculating a plurality of compression-spectral enhancement gain coefficients from said plurality of frequency domain gain coefficients and said plurality of spectral enhancement gain coefficients;

applying an inverse frequency domain transform on said plurality of compression-spectral enhancement gain coefficients to form a set of time-domain filter coefficients; and

convolving said sequence of delayed samples with said set of time-domain filter coefficients to produce a digital output signal.